

# LnTEMS™ ABTLx : EMS for ABT Metering

With the introduction of Availability Based Tariff Regime from January 2003, Generation Companies need to install/ implement systems to comply with the Tariff Requirements. L&T AUTOMATION has a comprehensive offering for ABT that includes LnTEMS™ABTLX Analysis Software, LnTSCM™- Advanced Data Concentrators and Customised ABT type ER300P Meters.

## Introduction

Integrated National Grid operations require the normalization of frequency across all five regions, which involve proactive load management by Beneficiaries (like State SEBs, etc.) and despatch discipline by Generators (like NTPC, NHPC & others).

Frequent fluctuations in frequency caused by short-term variations in the demand supply gap due to the tripping of load or outage of a generator or a transmission line impose substantial costs on generators and consumers. In addition, under the non-ABT regime, generators are having a financial incentive to go on generating even when there may be no demand. This results in high frequency on the grid as is endemic in the Eastern Region. Hence, inducing grid discipline by complying with ABT requirements has become mandatory and pre-requisite for a stable and reliable National Grid.

## Availability Based Tariff

Central Electricity Regulatory Commission (CERC), which is spearheading the ABT implementation, defines ABT as below:

- It is a performance-based tariff for the supply of electricity by Generators.
- It is also a new system of scheduling and despatch, which requires both Generators and Beneficiaries to commit to day-ahead schedules.
- It is a system of rewards and penalties seeking to enforce "day ahead" pre-committed schedules, though variations are permitted if notified one and one half-hours in advance.

ABT tariff basically consist of three parts:

- A fixed charge (FC) payable every month by each Beneficiary i.e. PGCIL or SEBs to the Generator for making capacity available for use and depends on the share of a Beneficiary. The FC, payable by each beneficiary, will also vary with the level of availability achieved by a Generator.
- An energy charge (defined as per the prevailing operational cost norms) per kWh of energy supplied as per a pre-committed schedule of supply drawn upon a daily basis.
- A charge for Unscheduled Interchange (UI charge) for the supply and consumption of energy in variation from the pre-committed daily schedule. This charge varies inversely with the system frequency prevailing at the time of supply/ consumption. The UI charges vary between 0 to 420 paise / kWh for the frequency range of 50.5 Hz to 49 Hz.. Hence it reflects marginal value of energy at the time of supply.

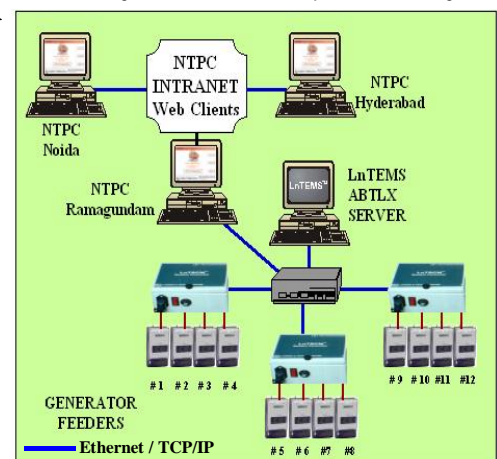
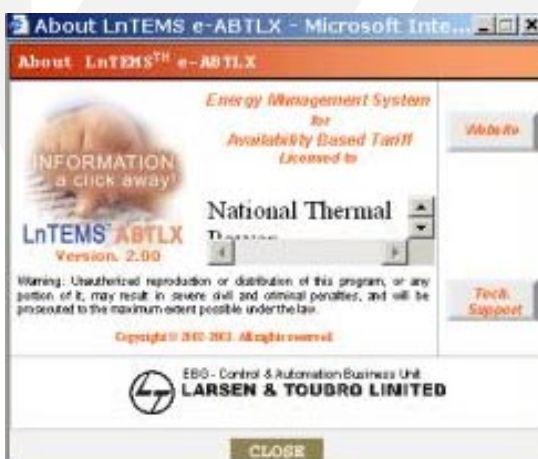
## L&T Solution:

A typical ABT installation consists of:

1. Customised ABT Energy Meters
2. Communication Network using LnTSCM™
3. LnTEMS™ ABTLX - ABT Analysis Software with e-ABTLX Web Module.

## ABT Energy Meter-ER300P

These Meters are of 0.2 Class accuracy Meters specifically Customised for Availability Based Tariff as prescribed by PGCIL / NTPC / NLC:



**Salient features of Meters:**

1. Carry out measurement of active energy (both import & export) and reactive energy (both import & export) by 3 phase, 4 wire principle suitable for balanced / unbalanced 3 phase load.
2. The instantaneous line frequency is also measured and averaged for 15 minutes and stored in the corresponding 15-min block register with a least count of 0.2Hz.
3. Continuously integrates the energy reading of each register up to the previous 15-min. block period.

**Communication Network with LnTSCM™**

The reliable and advanced LnTSCM™ –System Controller Module, defines the Communication Network. One of the latest products from L&T Automation stable, this Customised and dedicated controller has 4 nos. of RS485 Ports with Modbus connectivity as input for Meters and 1 no. 10MBPS Ethernet /TCP/IP connection on the output for connectivity to Computer having LnTEMS™ ABTLX Software. The Meter is connected to enhanced LnTSCM™ on the RS485 communication Port (i.e. one RS485 Port is dedicated to one Meter only) which enhances the response time of the system, makes it modular and failure of any meter does not affect the response of the entire system. Thus, the user gets the speed of an Ethernet Meter at one third of the price.

**LnTEMS™ABTLX - ABT Analysis Software**

Availability Based Tariff is basically a method of bringing the average Actual Generation to meet the Scheduled Generation by maintaining the frequency above 50Hz to avoid penalties. Every day at 00.00 Hrs., the Authorised Operator feeds the Declared Capability (DC) and the Scheduled Generation data of the next 24 hours for 15-minute blocks (total 96 blocks) for the next day.

The Operator monitors the real time data available through the LnTEMS™ software on a continuous basis by polling the ABT Meters. The screen below, shows the Real time data at any particular instant and gives details of Instantaneous Ex-Bus Gen.,

Block No.	Time Block	DC (MW)	SG (MW)
44	10:45-11:00	1835	1835
45	11:00-11:15	1835	1835
46	11:15-11:30	1835	1835
47	11:30-11:45	1835	1835

Average Ex-Bus Gen. (AG), Inst. Freq., Running Avg. Freq. & previous 15 min. block information for the operator to know the UI changes {Unscheduled Interchange (UI) = Scheduled Generation (SG) – Actual Generation (AG)}.

Based on the Average Ex-bus generation and the Scheduled generation for the particular block period of 15 min., the software calculates the Suggested Generation (using a complex algorithm) for the remaining time of the block to avoid penalties or minimise the gap between Average Generation for the block and the Scheduled Generation of the block. The screen, hence, gives a complete snapshot of the total system behavior for Availability Based Tariff and helps in decision making for the Operator.

**TRENDS:**

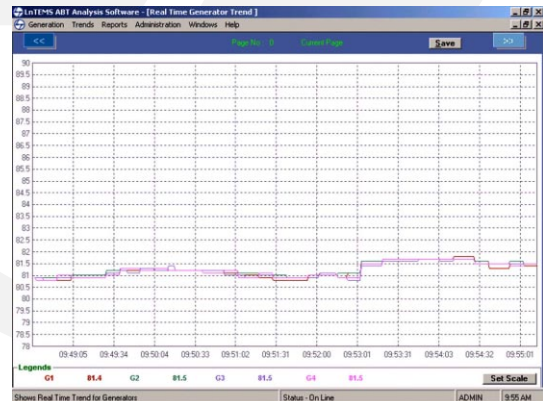
Another important feature of LnTEMS™ is Real Time trend and Historical trend of Declared Capability, Scheduled Generation, Actual Generation, Instantaneous MW / frequency and Average Frequency with respect to the Time Block (having adjustable resolution) on a X-Y Plot. The trends give a feel of the system behavior vis-à-vis the various operational parameters of the Energy Management System.

**X- Axis:**

Time Block (00/00, 00.15 etc or 1-96 blocs etc)

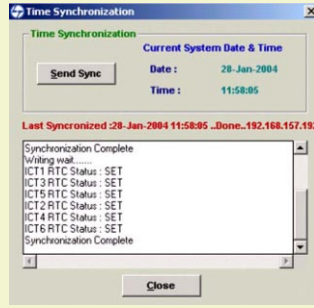
**Y-Axis: MW/Hz**

Plotting Variables: DC, Scheduled Input MW, Actual MW, Inst. MW/F, Avg. Frequency



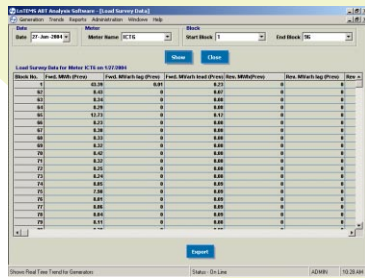
## Time Synchronisation

The **Send Sync** command of the Software allows the User to synchronize the entire system to a common reference Clock. When the command is given, all the Meters are synchronised to the LnTEMS ABTLx Server Time. The Server is synchronised by the Plant Master GPS Clock.



## Load Profile Download

A unique feature of the Software is the ability to download the load profile of the Meters directly from the LnTSCM in the case of communication failure between LnTSCM and Server.



## REPORTS:

The most important and essential feature of any Software are the Reports Module. Availability Based Tariff being a benchmark in terms of grid discipline, L&T worked in close association with Generation Company to evolve reports, which were customised for the particular tariff regime. The ABT Report is generated (shift wise/ end of day / monthly/ yearly) and includes:

1. Block No. [1-96]
2. Time-block [00.00 to 00.15 etc];
3. Declared Capability MW
4. Scheduled Ex-Bus MW
5. Average Ex-Bus MW
6. Average Frequency [Hz];
7. Unscheduled Interchange [Actual MW minus Scheduled MW];
8. UI Rate; UI in Rs. for the time block;
9. Reasons for UI duration.

The Reports are mainly based on:

### a. The Cost Analysis with respect to UI:

Tariff (in Rs.) = Tariff Rate \* Generation in MWH  
Gain / Loss (in Rs.) = UI (in Rs.) – Tariff (in Rs.)  
Where UI conditions are:

- = Actual Gen (AG) – Schedule Gen. (SG) when Actual Gen. < = Declared Capability
- = Declared Capability (DC) - Schedule Gen. (SG) when Actual Gen. > Declared Capability

### b. Fuel Saving and UI:

As ABT Tariff Regime does not provide any incentive for excess generation, it is imperative that the Actual Generation is as close as possible to the Schedule Generation.

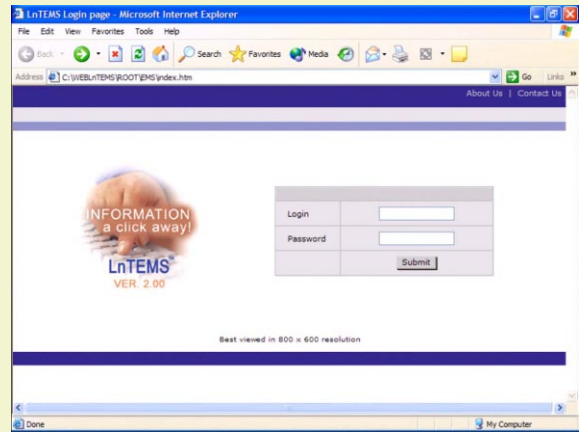
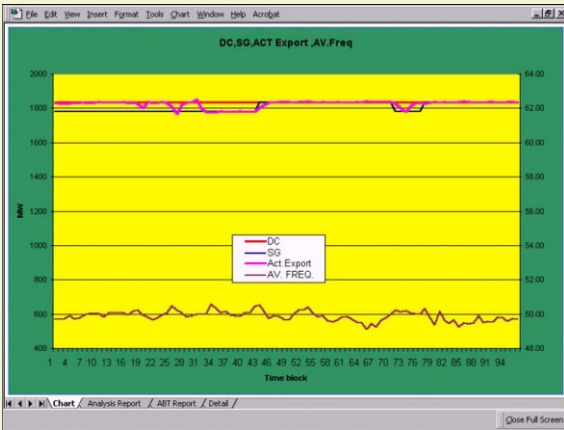
## Benefits of LnTEMS™ ABTLx

The benefits to Generation Companies are multifold:

1. Real time information/ snapshot of Generation resulting in “control decisions” to maintain frequency and minimise UI.
2. Presently many generating companies use Transducer and PLC/RTU combination, which gives a max. accuracy of 1%. The system offered consists of Energy meters with 0.2 % accuracy, which replaces the Transducer-RTU System resulting in a more accurate information.
3. With 0.2% accuracy of the Measuring system, the Operators are able to reduce the gap between Actual Generation and

Scheduled Generation to 1-3MW from 5-8MW resulting in savings of approximately Rs. 1 lakh per day for a 1800MW plant. Hence Pay back period for the entire system is just a few months.

4. Suggested Generation for the remaining period of a block provided by the LnTEMS™ algorithm minimises the Penalty for positive UI and maximises savings in Fuel for negative UI.
5. The comprehensive reports help Generation companies to analyse the behavior of the beneficiaries for the next block, day, month, season, year etc.



BLOCK NO	BLOCK TIME	AVG. FREQ.	AVG. EXPORT	SG	DC	UI	UI Rate
1	00:00-00:15	50.14	2005.11	1960.0	2000.0	45.11	1.008
2	00:15-00:30	49.92	2005.21	1960.0	2000.0	45.21	1.624
3	00:30-00:45	49.98	2006.51	1960.0	2000.0	46.51	1.456
4	00:45-01:00	50.08	2019.12	1960.0	2000.0	59.12	1.176
5	01:00-01:15	50.11	2035.11	1960.0	2000.0	75.11	1.12
6	01:15-01:30	50.03	2030.26	1960.0	2000.0	70.26	1.344
7	01:30-01:45	50.02	2030.28	1960.0	2000.0	70.28	1.344
8	01:45-02:00	50.47	2042.28	1960.0	2000.0	85.28	0.112
9	02:00-02:15	50.38	2042.44	1960.0	2000.0	82.44	0.336
10	02:15-02:30	50.19	2031.28	1960.0	2000.0	71.28	0.896
11	02:30-02:45	50.26	2037.28	1960.0	2000.0	77.27	0.672
12	02:45-03:00	50.41	2047.02	1960.0	2000.0	87.02	0.72

### Web Module : LnTEMS™ e-ABTLx:

The Web Module is another unique feature of this system. The Generator's requirement of information at wide Geographical Locations through WAN / LAN Intranet is facilitated by this module. Whether it is the Head Office, Regional Office or the CMD's Room, the information is just a click on the Internet Explorer. The Web Module provides information on Generation, SG, individual generation, Block / Instantaneous trends , UI rate, Daily Schedule, Daily Reports

### Conclusion

Electricity is an essential part of the Nations Prosperity, GDP and growth. Availability Based Tariff regime is one big / major step towards re-enforcement of grid discipline for both Generators as well as Beneficiaries, and L&T Automation is proud to have a comprehensive Energy Management System for this National need.



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